X,Y – Coordinates: Location Planning

Module

Developed in 2007 by

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Module Summary

Overview of Module

In this module students will determine the best location for a distribution center using the Cartesian plane and various maps. This module works best for students in grades 9-12.

Primary Career Cluster

Transportation, Distribution and Logistics-- Logistics Planning and Management Pathway

Recommended Subject Areas: Algebra I/Algebra II

Cluster Knowledge and Skills and Performance Elements

Academic Foundations

- ESS01.03.06 Construct charts/tables/graphs from functions and data.
- ESS01.04.02 Apply scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions and problem identification.

Problem-Solving and Critical Thinking

- ESS03.01.05 Evaluate ideas, proposals and solutions to problems.
- ESS03.04.02 Gather technical information and data using a variety of resources.

Leadership and Teamwork

- ESS07.03.01 Work with others to achieve objectives in a timely manner.

Next Generation Science Standards

- HS-PS4.C: Information Technologies and Instrumentation
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Common Core Standards

Mathematics

- A-REI 10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

- F-IF 5 Relate the domain of a function to its graph and where applicable to the quantitative relationship it describes.

Materials:

- Indiana Map
- U.S. Map
- Calculator

Job Connection:

- Duke Realty – www.dukerealty.com
  - Development - Associates in Duke's Development Group are responsible for completing due diligence activities to ensure that each project is developed to its full potential and for managing schedules and controlling site-related costs pertaining to land positions. Though each project is unique, the pre-construction items typically addressed by the Development Group include land acquisition, physical characteristics of the property, zoning, planning, engineering, and permitting.
  - http://www.dukerealty.com/company/careers/department.aspx#le

Vocabulary:

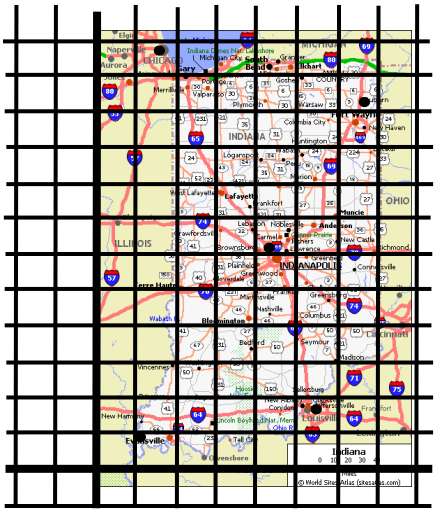
Distribution Center: A warehouse or other specialized building which is stocked with products to be re-distributed to retailers, wholesalers, or consumers

Cartesian plane: Another name for the rectangular coordinate system. The plane contains the intersection of the x and y axis.

Lesson Plan: X, Y – Coordinates: Location Planning

- **Introduction:**
  - Visit Duke Realty Website
    - What does the company do?
    - What type of careers are can you have at Duke Realty?
    - Why is this type of business important?
- Use the slides in the Appendix to discuss the following content.

  - How would you decide where to locate a distribution center if you knew the number of truckloads per week going to each retail store in the state of Indiana?
  - Take a look at this example:



City	Loads	X	Y
Indianapolis	50		
Gary	40		
Fort Wayne	45		
Evansville	25		
Louisville	30		

  - Use the Coordinate system to determine which coordinate is best location for the distribution center

City	Loads	X	Y
Indianapolis	50	4.2	6.1
Gary	40	1.6	11.8
Fort Wayne	45	6.7	10.2
Evansville	25	1.0	1.0
Louisville	30	5.4	1.8
sum	190		

$$x = \frac{4.2(50) + 1.6(40) + 6.7(45) + 1.0(25) + 5.4(30)}{190}$$

$$y = \frac{6.1(50) + 11.8(40) + 10.2(45) + 1.0(25) + 1.8(30)}{190}$$

x=4.0

y=6.9

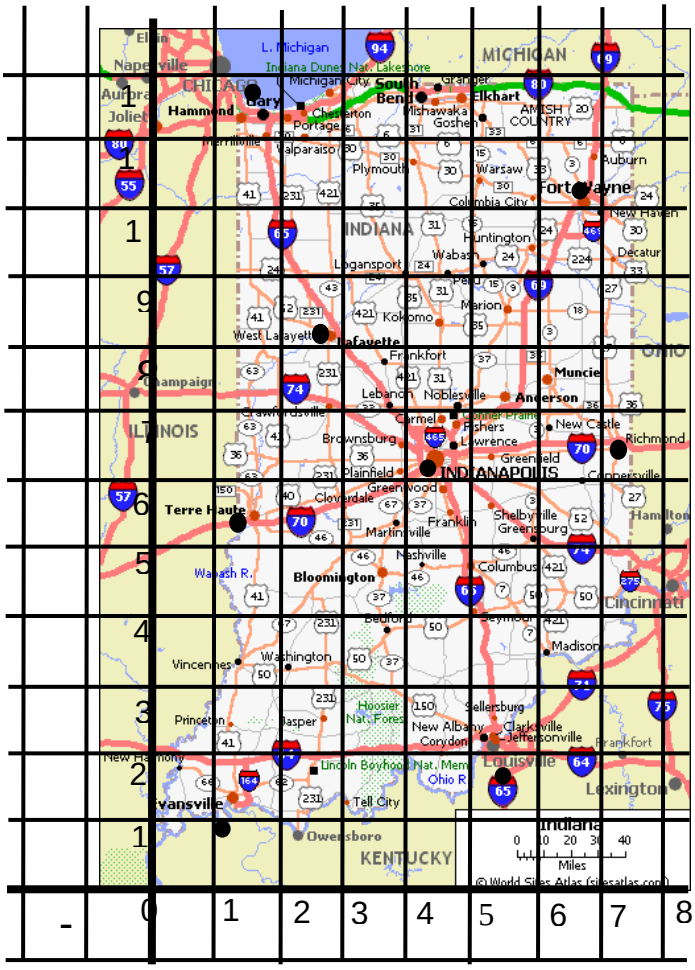
- What city is the closest to the point (4.0, 6.9) on the graph?

- **Distribute Handout 1, Location Planning Worksheet and have students complete in class or as homework.**

- **Go over answers of Handout 1 which can be found in slides 9-10 in the Appendix .**

- **ASSESSMENT:** Have students work in groups to complete two additional examples. One example will be in the state of Indiana; the other will be using the whole United States. Distribute Handout 2, Assessment, for information about this problem.

Location Planning Worksheet



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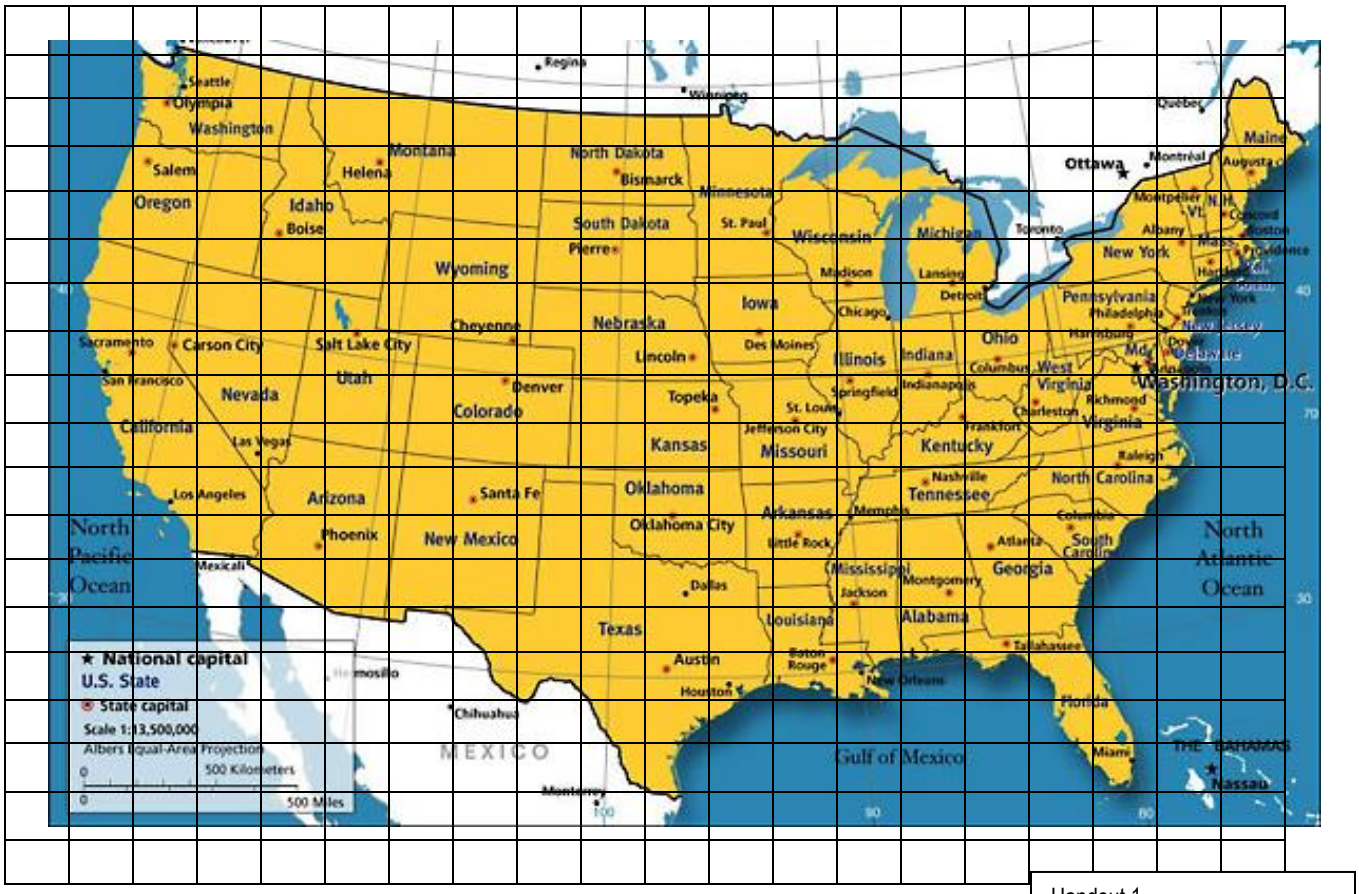
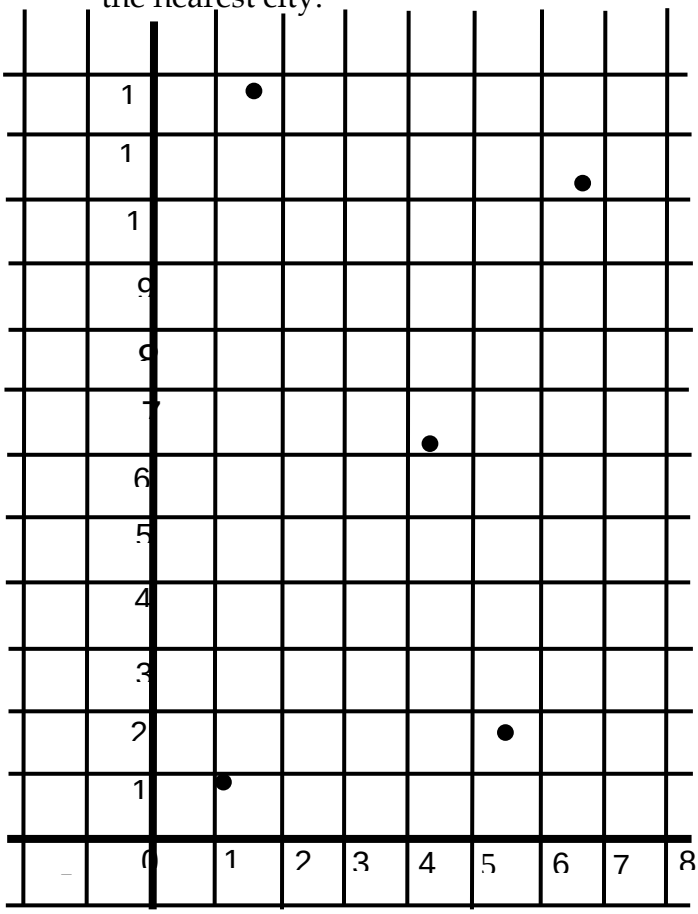
City	Loads	X	Y
Indianapolis	10		
Gary	7		
Fort Wayne	8		
Evansville	2		
Louisville	3		
Lafayette	1		
Terre Haute	1		
Richmond	1		



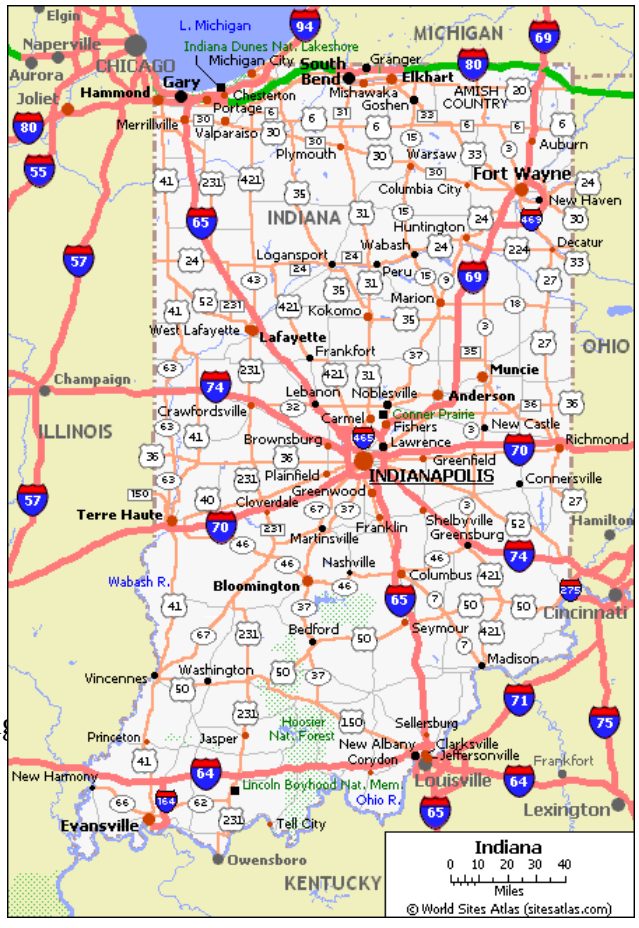
Handout 1
X,Y Coordinates Module

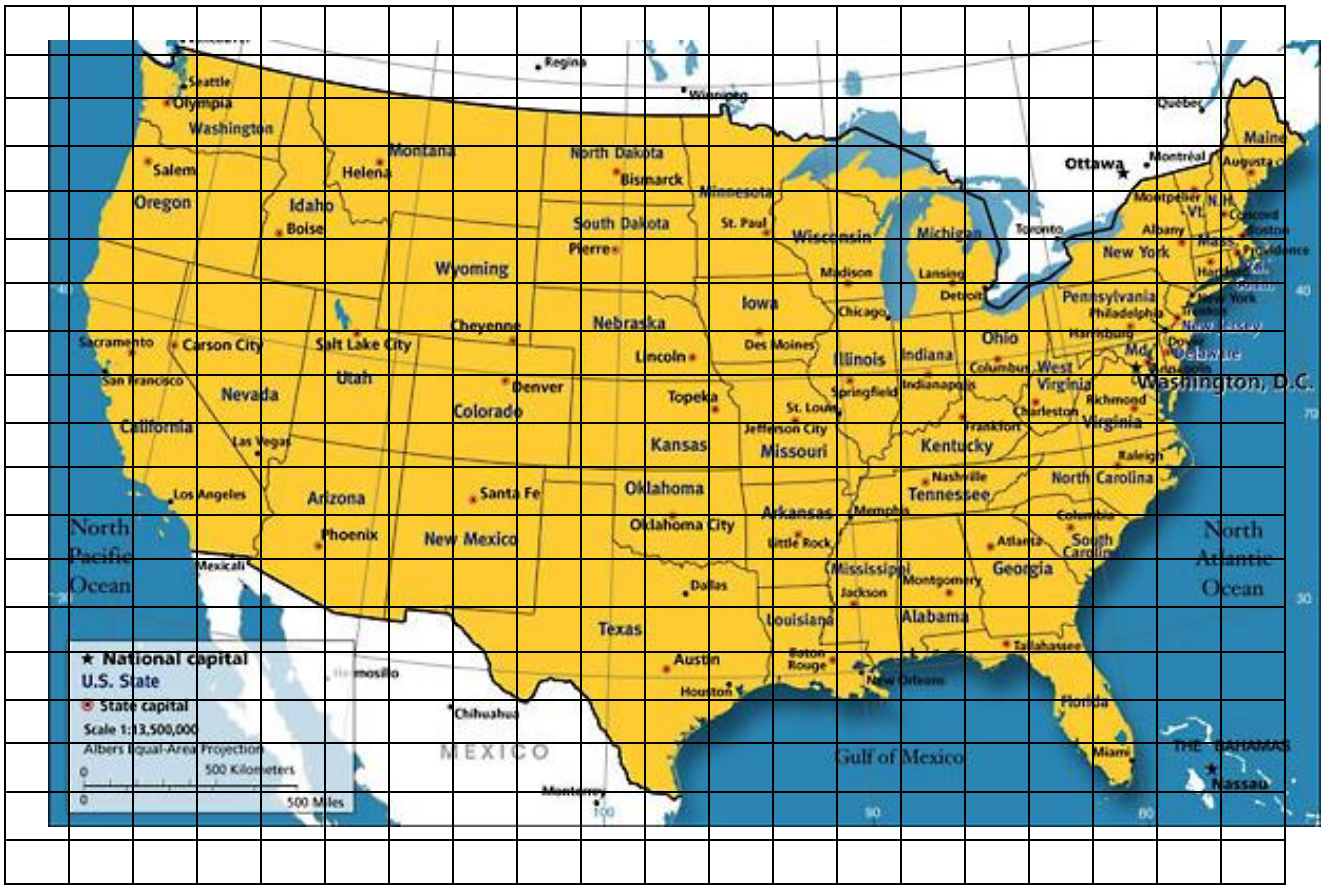
City	**Loads**	**X**	Y
Indianapolis	50		
Springfield	30		
Los Angeles	85		
Denver	75		
Atlanta	50		
Las Vegas	25		
Chicago	95		
Dallas	60		
Columbus	50		

Find the best location for a Distribution center. Please give the coordinate and the nearest city.



City	Loads	X	Y
Indianapolis	25		
Gary	50		
Fort Wayne	35		
Evansville	4		
Louisville	15		





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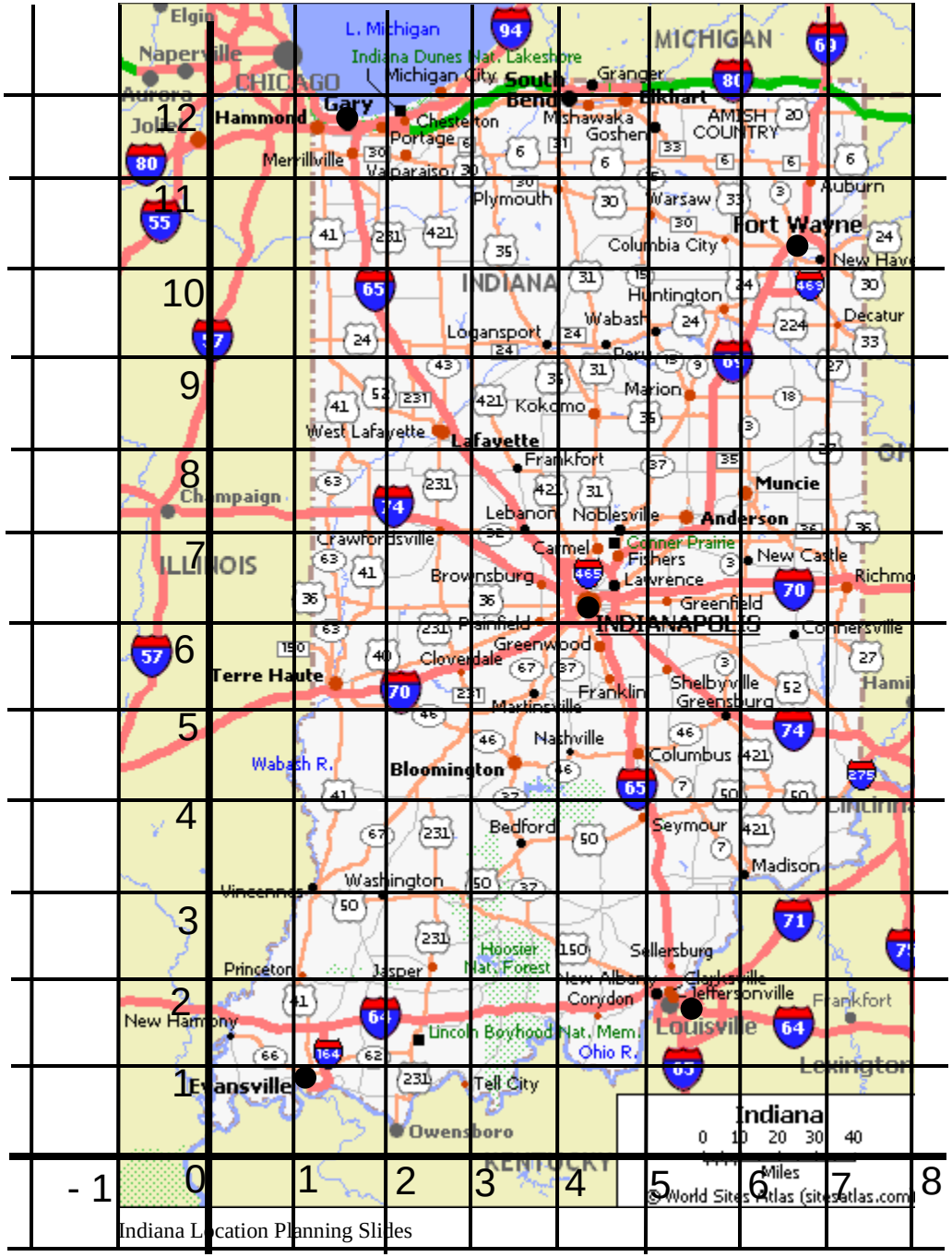
A P P E N D I X

Location Planning

How would you decide where to locate a distribution center if you knew the number of truckloads per week going to each retail store in the state of Indiana?


Elgin
Naperville
CHICAGO
Aurora
Joliet
L. Michigan
Indiana Dunes Nat. Lakeshore
Michigan City
Gary
Hammond
Merrillville
Valparaiso
Chesterton
Portage
South Bend
Granger
Mishawaka
Goshen
Elkhart
AMISH COUNTRY
MICHIGAN
Plymouth
Warsaw
Auburn
Fort Wayne
Columbia City
New Haven
INDIANA
Huntington
Wabash
Logansport
Peru
Decatur
Marion
Kokomo
West Lafayette
Lafayette
Frankfort
Champaign
Muncie
Lebanon
Noblesville
Anderson
Crawfordsville
Carmel
Conner Prairie
Fishers
New Castle
Richmond
ILLINOIS
Brownsburg
Lawrence
Greenfield
INDIANAPOLIS
Plainfield
Connersville
Greenwood
Clovendale
Terre Haute
Franklin
Shelbyville
Greensburg
Martinsville
Nashville
Columbus
Wabash R.
Bloomington
Bedford
Seymour
Madison
Vincennes
Washington
Hoosier Nat. Forest
Sellersburg
New Albany
Clarksville
Jeffersonville
Corydon
Frankfort
Princeton
Jasper
New Harmony
Lincoln Boyhood Nat. Mem.
Ohio R.
Louisville
Lexington
Evansville
Tell City
Owensboro
KENTUCKY
Indiana
0 10 20 30 40
Miles
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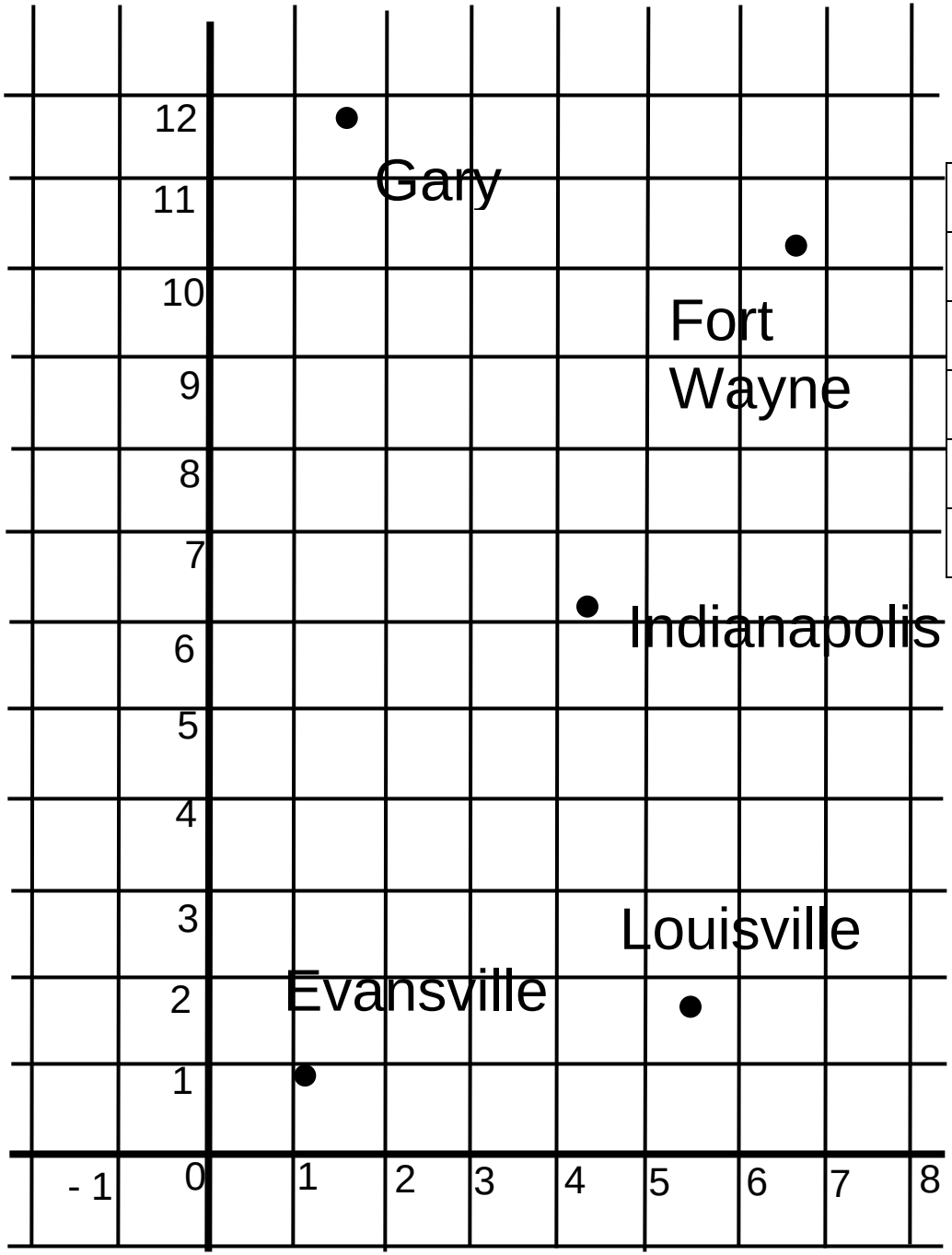

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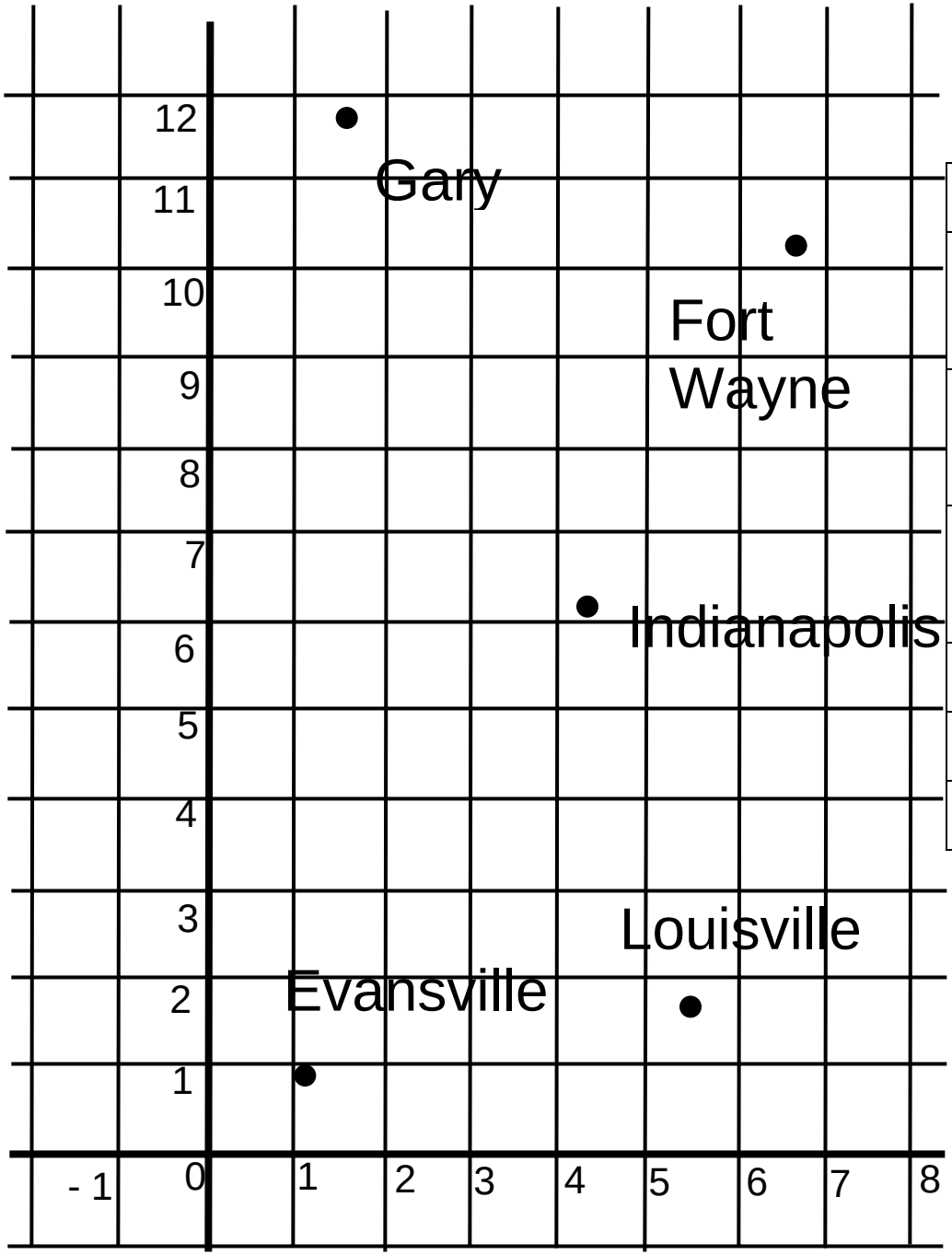

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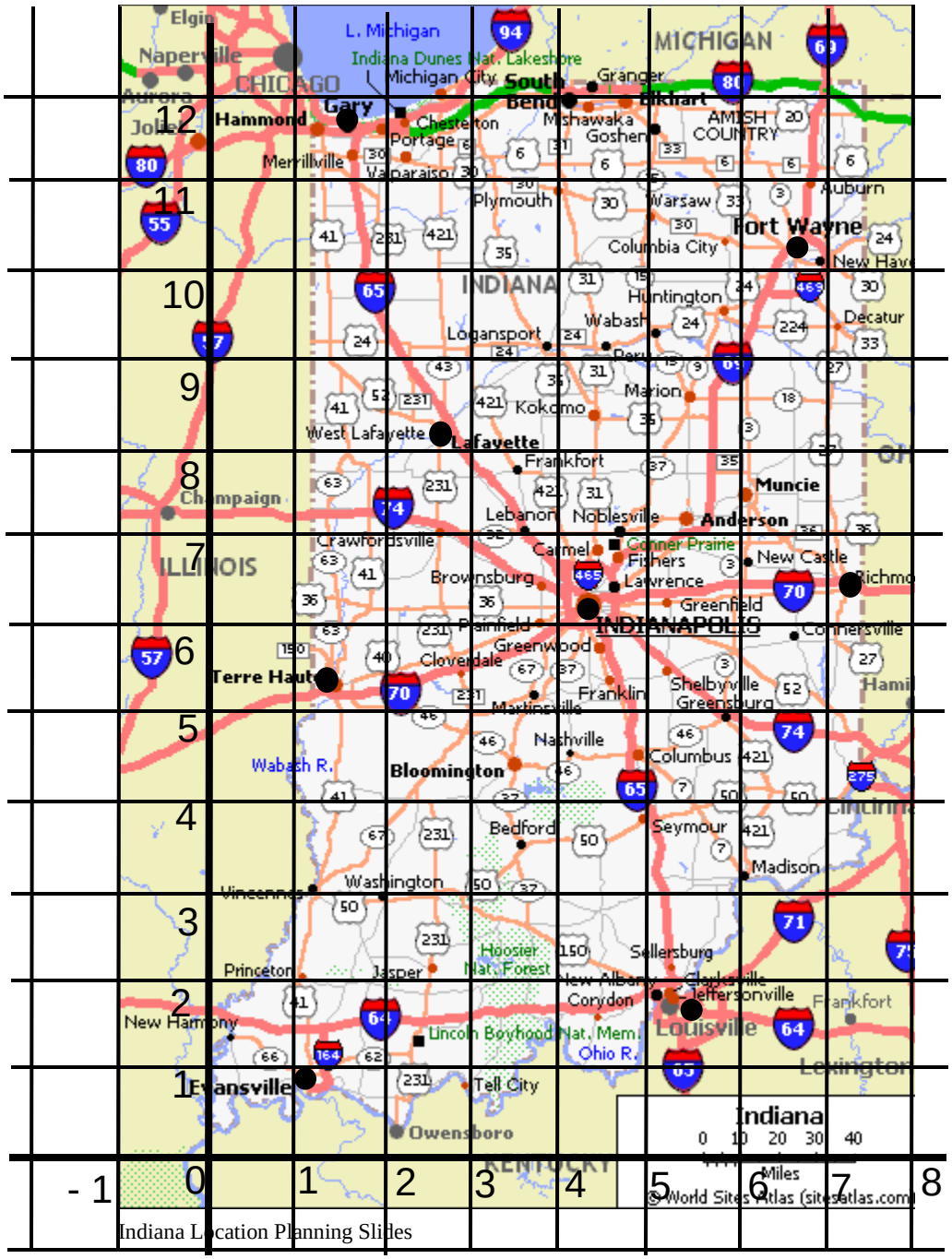
Elgin
Naperville
CHICAGO
Aurora
Joliet
Gary
Hammond
Merrillville
Portage
Chesterton
Valparaiso
L. Michigan
Indiana Dunes Nat. Lakeshore
Michigan City
South Bend
Granger
Mishawaka
Goshen
Elkhart
MICHIGAN
AMISH COUNTRY
Plymouth
Warsaw
Auburn
Fort Wayne
Columbia City
New Haven
INDIANA
Huntington
Wabash
Logansport
Peru
Decatur
Marion
Kokomo
West Lafayette
Lafayette
Frankfort
Champaign
Muncie
Lebanon
Noblesville
Anderson
Crawfordsville
Carmel
Conner Prairie
Fishers
New Castle
ILLINOIS
Brownsburg
Lawrence
Greenfield
INDIANAPOLIS
Plainfield
Greenwood
Connersville
Terre Haute
Clovendale
Franklin
Shelbyville
Greensburg
Martinsville
Nashville
Columbus
Wabash R.
Bloomington
Bedford
Seymour
Madison
Vincennes
Washington
Hoosier Nat. Forest
Sellersburg
Princeton
Jasper
New Albany
Clarksville
Jeffersonville
Corydon
Frankfort
New Harmony
Lincoln Boyhood Nat. Mem.
Louisville
Ohio R.
Lexington
Evansville
Tell City
Owensboro
KENTUCKY
Indiana
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Miles
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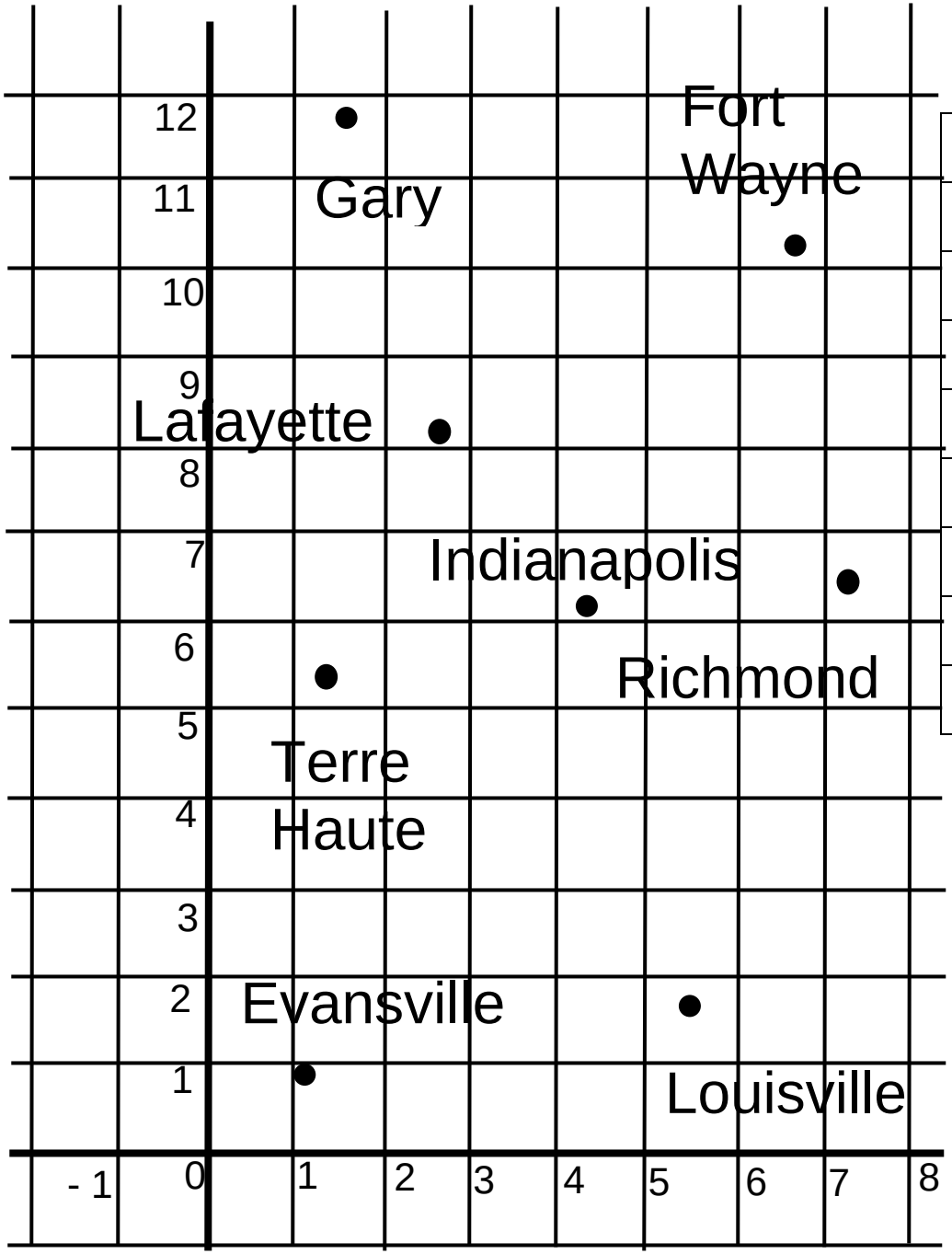

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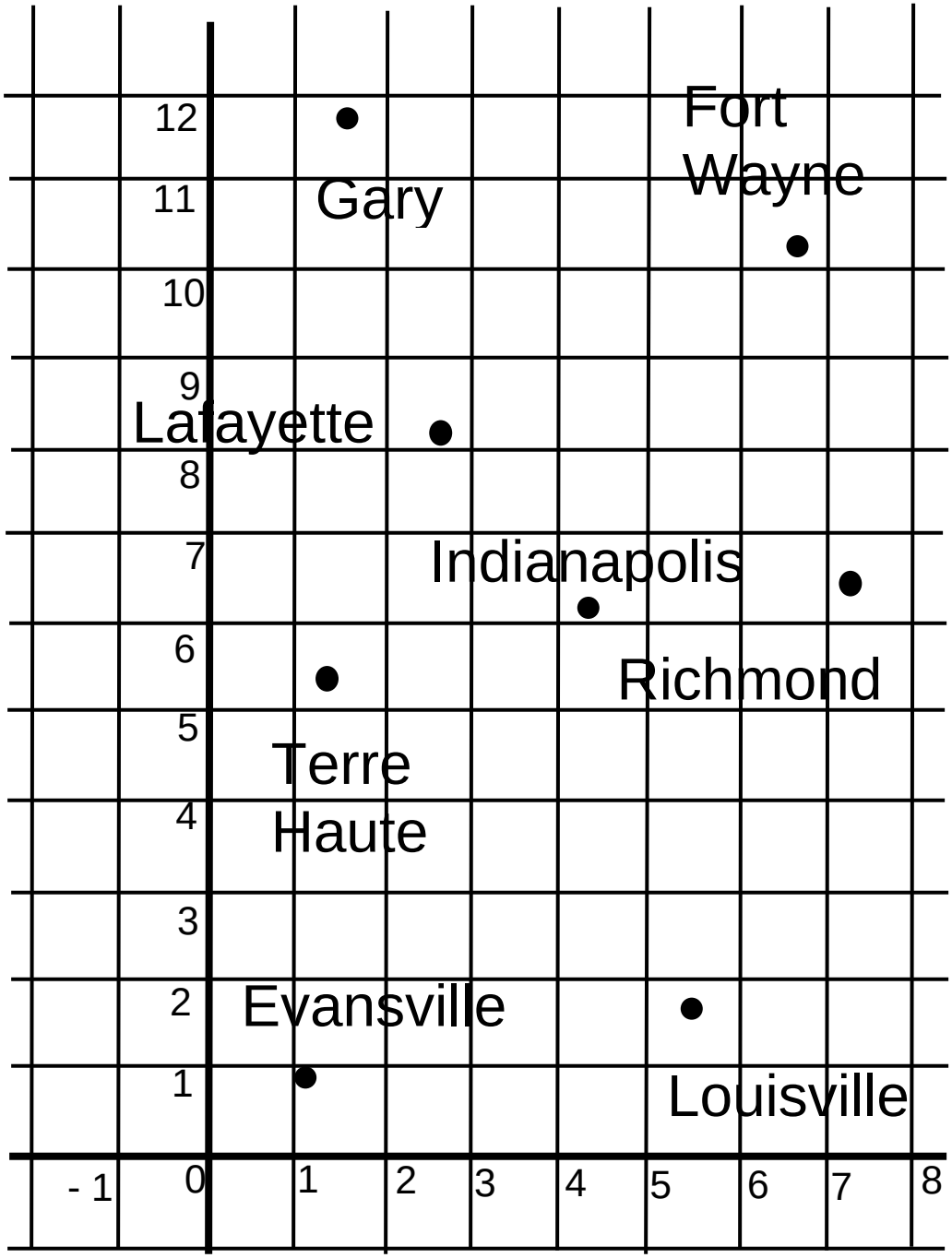

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Evansville	2	1.0	1.0
Louisville	3	5.4	1.8
Lafayette	1	2.8	8.1
Terre Haute	1	1.2	5.4
Richmond	1	7.1	6.5

$$x = \frac{4.2(10) + 1.6(7) + 6.7(8) + 1.0(2) + 5.4(3) + 2.8(1) + 1.2(1) + 7.1(1)}{33}$$

$$y = \frac{6.1(10) + 11.8(7) + 10.2(8) + 1.0(2) + 1.8(3) + 8.1(1) + 5.4(1) + 6.5(1)}{33}$$

x=4.1

y=7.7